

1 **CLAIMS**

2 1. A method comprising:

3 rendering a polygonal mesh to produce a computer-generated image, the
4 image exhibiting aliasing at its discontinuity edges; and

5 overdrawing the discontinuity edges as antialiased lines to reduce the
6 aliasing.

7 2. A method as recited in claim 1, wherein the polygon mesh comprises

8 a set of triangles.

9 3. A method as recited in claim 1, wherein the image is stored in

10 memory after rendering, and the overdrawing comprises rendering the
11 discontinuity edges as antialiased lines in the memory to reduce the aliasing at the
12 discontinuity edges.

13 4. A method as recited in claim 1, further comprising identifying the

14 discontinuity edges as a collection of silhouettes and sharp edges.

15 5. A method as recited in claim 1, further comprising:

16 identifying sharp edges prior to said rendering; and

17 finding silhouette edges during runtime, the discontinuity edges being a
18 union of the sharp edges and the silhouette edges.

1 6. A method as recited in claim 1, further comprising shading the
2 discontinuity edges.

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4 7. A method as recited in claim 1, further comprising blending selected
5 discontinuity edges.

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7 8. A method as recited in claim 1, further comprising orienting the
8 discontinuity edges in a consistent manner.

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10 9. A method as recited in claim 1, further comprising asymmetrically
11 blending selected discontinuity edges.

12
13 10. A method as recited in claim 1, further comprising sorting the
14 discontinuity edges prior to said overdrawing.

15
16 11. One or more computer-readable media comprising computer-
17 executable instructions that, when executed, perform the method as recited in
18 claim 1.

19
20 12. A method comprising:
21 determining discontinuity edges of a polygon mesh; and
22 overdrawing the discontinuity edges as antialiased lines.

1 **13.** A method as recited in claim 12, wherein said determining
2 comprises identifying sharp edges and silhouettes.

3
4 **14.** A method as recited in claim 12, wherein said determining
5 comprises:

6 identifying sharp edges during a preprocess prior to rendering the polygon
7 mesh; and

8 finding silhouette edges during runtime after rendering the polygon mesh.

9
10 **15.** A method as recited in claim 12, further comprising shading the
11 discontinuity edges.

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13 **16.** A method as recited in claim 12, further comprising blending
14 selected discontinuity edges.

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16 **17.** A method as recited in claim 12, further comprising asymmetrically
17 blending selected discontinuity edges.

18
19 **18.** A method as recited in claim 12, further comprising orienting the
20 discontinuity edges in a consistent manner.

21
22 **19.** A method as recited in claim 12, further comprising sorting the
23 discontinuity edges prior to said overdrawing.

1 **20.** One or more computer-readable media comprising computer-
2 executable instructions that, when executed, perform the method as recited in
3 claim 12.

4
5 **21.** In a process for rendering computer-generated graphics, a method
6 comprising:

7 constructing a data structure prior to rendering a polygon mesh; and
8 finding silhouette edges in the polygon mesh during runtime using the data
9 structure; and
10 omitting concave silhouette edges from the data structure.

11
12 **22.** A method as recited in claim 21, further comprising overdrawing the
13 silhouette edges as antialiased lines.

14
15 **23.** A method as recited in claim 21, further comprising shading the
16 silhouette edges.

17
18 **24.** A method as recited in claim 21, further comprising blending
19 selected silhouette edges.

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21 **25.** A method as recited in claim 21, further comprising asymmetrically
22 blending selected silhouette edges.

1 **26.** A method as recited in claim 21, further comprising sorting the
2 silhouette edges.

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4 **27.** One or more computer-readable media comprising computer-
5 executable instructions that, when executed, perform the method as recited in
6 claim 21.

7
8 **28.** In a process for rendering computer-generated graphics, a method
9 comprising:

10 identifying sharp edges prior to runtime;
11 constructing a data structure prior to rendering a polygon mesh;
12 finding silhouette edges in the polygon mesh during runtime using the data
13 structure; and
14 collecting the sharp edges and the silhouette edges in a list to form
15 discontinuity edges of the polygon mesh.

16
17 **29.** A method as recited in claim 28, further comprising shading the
18 discontinuity edges.

19
20 **30.** A method as recited in claim 28, further comprising blending
21 selected discontinuity edges.

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23 **31.** A method as recited in claim 28, further comprising asymmetrically
24 blending selected discontinuity edges.

1 **32.** A method as recited in claim 28, further comprising sorting the
2 discontinuity edges.

3
4 **33.** One or more computer-readable media comprising computer-
5 executable instructions that, when executed, perform the method as recited in
6 claim 28.

7
8 **34.** A method comprising:

9 rendering a polygonal mesh;

10 determining discontinuity edges of the polygon mesh;

11 sorting the discontinuity edges according to visibility; and

12 overdrawing the discontinuity edges in an order resulting from said sorting.

13
14 **35.** A method as recited in claim 34, wherein said determining
15 comprises:

16 identifying sharp edges prior to said rendering; and

17 finding silhouette edges during runtime, the discontinuity edges being a
18 union of the sharp edges and the silhouette edges.

19
20 **36.** A method as recited in claim 34, wherein said sorting comprises
21 sorting the discontinuity edges according to depth.

22
23 **37.** A method as recited in claim 34, wherein said overdrawing
24 comprises overdrawing the discontinuity edges as antialiased lines.

1 **38.** A method as recited in claim 34, further comprising shading the
2 discontinuity edges.

3
4 **39.** A method as recited in claim 34, further comprising blending
5 selected discontinuity edges.

6
7 **40.** A method as recited in claim 34, further comprising asymmetrically
8 blending selected discontinuity edges.

9
10 **41.** A method as recited in claim 34, further comprising orienting the
11 discontinuity edges in a consistent manner.

12
13 **42.** One or more computer-readable media comprising computer-
14 executable instructions that, when executed, perform the method as recited in
15 claim 21.

16
17 **43.** A method comprising:
18 rendering a polygonal mesh;
19 identifying one or more silhouette edges of the polygon mesh for a given
20 viewpoint; and
21 overdrawing the silhouette edges as antialiased lines.

22
23 **44.** A method as recited in claim 43, wherein the identifying comprises:
24 constructing a data structure prior to rendering the image;
25 finding the silhouette edges during runtime using the data structure; and

storing the silhouette edges in an output list.

45. A method as recited in claim 43, further comprising shading the silhouette edges.

46. A method as recited in claim 43, further comprising sorting the silhouette edges prior to said overdrawing.

47. One or more computer-readable media comprising computer-executable instructions that, when executed, perform the method as recited in claim 43.

48. A method comprising:

A. during a preprocess phase, performing the following:

identifying sharp edges present in a polygon mesh used to generate a graphical image;

constructing a data structure to store possible silhouette edges identified during a subsequent runtime phase;

B. during the runtime phase, performing the following:

rendering the polygonal mesh to produce a rendered image;

identifying silhouette edges that occur from a given viewpoint of the rendered image using the data structure, the silhouette edges together with the sharp edges forming a set of discontinuity edges;

shading the discontinuity edges;

sorting the discontinuity edges; and

overdrawing the discontinuity edges as antialiased lines.

49. A method as recited in claim 48, wherein the sorting comprises sorting the discontinuity edges according to depth.

50. A method as recited in claim 48, wherein the shading comprises asymmetrically shading the discontinuity edges.

51. A method as recited in claim 48, wherein the shading comprises applying blending processes that balance temporal smoothness and spatial sharpness.

52. A method as recited in claim 48, wherein the shading comprises orienting the discontinuity edges in a consistent manner.

53. A graphics computing device comprising:

- a memory to store a polygon mesh; and
- a processing unit to render the polygon mesh, the processing unit being further configured to overdraw discontinuity edges of the polygon mesh as antialiased lines.

54. A graphics computing device as recited in claim 53, wherein the polygon mesh comprises a set of triangles.

1 **55.** A graphics computing device as recited in claim 53, wherein the
2 processing unit is configured to detect the discontinuity edges as a collection of
3 sharp edges and silhouettes.

4

5 **56.** A graphics computing device as recited in claim 53, wherein the
6 processing unit comprises:

7 a central processing unit configured to detect the discontinuity edges; and
8 a graphics processing unit configured to render the polygon mesh and to
9 overdraw the discontinuity edges.

10

11 **57.** A graphics computing device as recited in claim 53, further
12 comprising a frame buffer to store the rendered mesh, the processing unit being
13 configured to render the discontinuity edges as antialiased lines in the frame
14 buffer.

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16 **58.** A graphics computing device as recited in claim 53, wherein the
17 processing unit is further configured to shade the discontinuity edges.

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19 **59.** A graphics computing device as recited in claim 53, wherein the
20 processing unit is further configured to blend selected discontinuity edges.

21

22 **60.** A graphics computing device as recited in claim 53, wherein the
23 processing unit is further configured to orient the discontinuity edges in a
24 consistent manner.

1 **61.** A graphics computing device as recited in claim 53, wherein the
2 processing unit is further configured to asymmetrically blend selected
3 discontinuity edges.

4

5 **62.** A graphics computing device as recited in claim 53, wherein the
6 processing unit is further configured to sort the discontinuity edges prior to
7 overdrawing them.

8

9 **63.** A graphics processing system comprising:
10 a renderer configured to render a polygon mesh;
11 a discontinuity edge detector configured to detect discontinuity edges in the
12 polygon mesh; and
13 an overdrawer configured to overdraw the discontinuity edges as antialiased
14 lines to reduce the aliasing.

15

16 **64.** A graphics processing system as recited in claim 63 further
17 comprising:
18 a data structure; and
19 the discontinuity edge detector being configured to find silhouette edges in
20 the polygon mesh using the data structure.

21

22 **65.** A graphics processing system as recited in claim 63 wherein the
23 discontinuity edge detector is further configured to identify sharp edges of the
24 polygon mesh prior to rendering the polygon mesh.

1 **66.** A graphics processing system as recited in claim 63 further
2 comprising an edge sorter to sort the discontinuity edges according to depth.

3
4 **67.** A graphics processing system as recited in claim 63 further
5 comprising a shading module to shade the discontinuity edges using asymmetric
6 blending.

7
8 **68.** A graphics computing device comprising the graphics processing
9 system as recited in claim 63.

10
11 **69.** One or more computer-readable media comprising computer-
12 executable instructions that, when executed, direct a graphics computing device to:
13 render a polygonal mesh;
14 detect discontinuity edges in the polygon mesh; and
15 overdraw the discontinuity edges as antialiased lines to reduce the aliasing.

16
17 **70.** One or more computer-readable media as recited in claim 69, further
18 comprising computer-executable instructions that, when executed, direct the
19 graphics computing device to:
20 identify sharp edges prior to rendering the polygon mesh; and
21 find silhouette edges after rendering the polygon mesh, the discontinuity
22 edges being a union of the sharp edges and the silhouette edges.

1 **71.** One or more computer-readable media as recited in claim 69, further
2 comprising computer-executable instructions that, when executed, direct the
3 graphics computing device to shade the discontinuity edges.

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5 **72.** One or more computer-readable media as recited in claim 69, further
6 comprising computer-executable instructions that, when executed, direct the
7 graphics computing device to sort the discontinuity edges according to depth.

8

9 **73.** One or more computer-readable media as recited in claim 69, further
10 comprising computer-executable instructions that, when executed, direct the
11 graphics computing device to:

12 orient the discontinuity edges in a consistent manner; and

13 blend the discontinuity edges using asymmetric blending.

14

15 **74.** A system comprising:

16 means for identifying sharp edges present in a polygon mesh;

17 means for rendering the polygonal mesh to produce a rendered image;

18 means for identifying silhouette edges that occur from at least one
19 viewpoint of the rendered image;

20 means for shading the discontinuity edges;

21 means for sorting the discontinuity edges; and

22 means for overdrawing the discontinuity edges as antialiased lines.